"Final Project Report to the NYS IPM Program, Agricultural IPM 2002-2003."

1. Title:

Evaluation of "Green Manure" Rotational Strategies for Potatoes in Upstate New York

2. Project Leader(s):
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3. Cooperator(s):
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4. Type of grant:
Cultural methods; sanitation; physical controls

5. Project location(s):
This work occurred in Franklin and Essex counties. Findings may be applied throughout the Northeast.

6. Abstract:
North Country potato growers, needing to rotate their fields, are faced with limited choices. Having a short growing season and because soil ph needs to be kept fairly acidic mean many of the options other vegetable growers employ are not available to potato growers. Wishing to maximize soil benefits while away from potatoes, growers have expressed the desire to look at rotational crops they are unfamiliar with. Sudangrass has been successfully employed by onion grower throughout the state as an excellent way to increase organic matter, break up soil hard pans and decrease soil pathogens. In recent years, crops in the mustard family used as green manure have shown soil benefits as well. We looked at yellow mustard and oilseed radish in combination with sudangrass as green manure in a rotation with potato.

The cold, wet spring delayed the growers from getting their potatoes and cash crops planted. Funding was not secured until early June and this also contributed to the late start of the trial. The first trial plantings did not occur till July 14 at the Late Placid location. The trial field in Malone was planted on July 28. Prior to planting, both locations were sampled for nematodes. Soil tests were also taken at both locations to evaluate for organic matter levels. Fifteen acre fields were divided into three five acre plots. One plot was planted in sudangrass, the second in yellow mustard and the third plot was planted in oil seed radish.

At the Lake Placid location, the mustard and oil seed radish plots were plowed down on August 29 and both fields were replanted in yellow mustard again. The sudangrass plot was left to grow as it was still quite small. These plots were then plowed down on September 21. In Malone, the three plots were left to grow till mid September and then plowed down.

Early next summer, we will again sample these fields for nematodes and do soil test. We will next be able to see if these rotational strategies had an impact on organic matter and nematode levels in the field.

7. Background and justification:

Potatoes are a high value crop. Any given year, up to half a potato growers soil resource is not making money. This being the situation, potato growers wish to maximize the benefits of rotational crops. Western potato growers and the University of Idaho have been experimenting with mustards (yellow mustard and oilseed radish) as green manure. Benefits reported include decreased nematode populations, increased soil quality and nutrient availability. Sudangrass has been employed successfully by New York onion growers. A large increase in organic matter, better soil water penetration, augmented weed control and less soil pathogens have been shown as results from utilizing sudangrass. Both sudangrass and mustard crops have been reported to control nematodes. The nematodes colonize the mustard roots and when plowed down green, kill those nematodes in the plant. Sudangrass works as a natural fumigant. After it is plowed down green, as it decomposes, a natural cyanide-like chemical is released, killing the nematodes. Increased stand counts and yields have been documented in onions after sudangrass.

Traditional rotational crops include buckwheat and oats. While relatively inexpensive to plant and maintain, they provide little in soil benefits. Also, grass cover crops are known to harbor nematodes. If a field is going to be out of potato production, than it makes sense to help the soil as much as possible benefit the following crops. Two North Country potato growers one located in Lake Placid and the other in Malone, participated in looking at the different rotational strategies.

Talking with the North Country potato growers, there were very interested in looking at different rotational ideas. They expressed they had no real idea of nematode levels in their soils. With the high expense of nematode testing, ($30 per sample and 20 samples per field) most growers have never tested for nematodes.

Rotation breaks the disease and insect cycle. We have chosen these rotational crops because of their specific strengths. There may not be a "silver bullet" rotational crop but by looking at different rotational strategies it is possible for growers to make better management decisions for their farms

8. Objectives:

1 - To increase the potato grower's ability to make sound cultural and economic rotational crop decisions.

2 – To evaluate yellow mustard, oilseed radish and sudangrass for ease of establishment, root depth, bio-mass and economic feasibility.

3 – To obtain base line data to be compared with next summer's data and results.

9. Procedures:

While small plot trials would work to evaluate the culture of these rotational crops, each grower wanted to further evaluate the fields under actual production conditions in 2002. This means employing field sized test plots and planting the test plot fields to potatoes in 2003. In 2003, we will then evaluate for nematode, soil organic matter levels and yield results.

Three growers had planned to participate in the trial. Things happen. One grower experienced a number of mechanical problems and never planted the seed for the trial. The other two growers, while unhappy with the late start, worked the trial into their schedules as best they could.

The two growers each divided a 15 acre field into three sections. They then planted the five acre plots into yellow mustard, oilseed radish and sudangrass. This happened at the Lake Placid location on July 14 and in Malone on July 28. In Lake Placid, the yellow mustard and oil seed radish fields were plowed down green on August 29. These two plots were then planted to yellow mustard. Because the sudangrass was slow to grow, it was allowed to continue growing. All three fields were then plowed down green on September 21. In Malone, all three fields were allowed to grow till September 24 and then plowed down.

10. Results and discussion:

Prior to planting, nematode sampling was carried out in both locations. Thirteen samples were taken from the Lake Placid location. Three samples were combined from the Malone location because of how the field was later planted. (Samples were held till September before they were evaluated. This may have impacted the nematode levels) Nematodes can be very spotty and we found this in both locations. For pratylenchus sp. (lesion) nematode, numbers above 150 are over thresholds established for implementing management practices according to the Cornell Diagnostic Laboratory.

Lake Placid location
Soil organic matter – 5.5%, 5.8%, 5.8%
13 samples

Free-living (beneficial) nematodes	pratylenchus sp. (lesion) nematodes
30	192
174	240
246	144
90	390
282	288
280	240
114	162
162	120
156	366
0	18
12	0
276	96
36	120

One location in Lake Placid had low levels of Hoplolaimus sp. (lance) nematodes. This was the only sample from both locations to have this nematode.

Malone location
Soil organic matter - 2.7%, 2.6%, 2.6%
9 samples* *three samples were combined

Free-living (beneficial) nematodes	pratylenchus sp. (lesion) nematodes
6	36
282	132
180	138
120	300
228	114
198	312
210	280
120	240
348	120

Fields evaluated for root depth. Ten samples were taken from each plot.

Lake Placid location

sudangrass	6.3 inches
oil seed radish	6.8 inches
yellow mustard	3.6 inches

Malone location

sudangrass	4.8 inches
oil seed radish	6.2 inches
yellow mustard	2.9 inches

The soil at the Lake Placid location had a fairly high soil organic matter level before the trial. This grower uses a buckwheat rotation on his fields and feels it gives him good results.

Richard Gast, the Franklin County Cornell Cooperative Extension Agricultural Technician conducted the field evaluations.

Sudangrass 50 lbs./acre - $24.00
Yellow mustard - 8 lbs./acre - $12.00
Oilseed radish - 25 lbs./acre - $55.00

We had wanted to get two or three plantings of the various cover crops planted and plowed in green. With the wet spring and the late starting date, it was not possible to have the multiple plantings as planned. We were able to look at different strategies. Both growers want to start earlier next year and do the multiple plantings of each cover crop. Once potato harvest starts in early September, it will be difficult to do any of these practices on a large scale. Between the end of potato planting and the start of harvest, it was felt at least two crops could be planted and plowed down green. The growers were interested in the yellow mustard as a winter cover. It does not harbor or over winter nematodes as grasses will do.

The sudangrass did not do well in either location. No fertilizer was applied and both growers felt with the lower ph potato ground, the sudangrass would have done much better had it received 50-75 lbs. at planting. Normally, sudangrass will grow a foot per month. We were surprised it did not grow as quickly as anticipated.

The mustard grew well. Mustard is very small seeded. One grower experienced an uneven stand in his field. He felt possible the size of the seed made it difficult to plant. The yellow mustard is inexpensive and grows quickly. It was felt if may make a good winter cover after harvest.

The oil seed radish grew quickly and well. The plant produces a large radish around 6 inches long. It will be interesting to see how it affects organic matter and nematode levels next year.

Seven out of thirteen locations in Lake Placid and six our of nine locations in Malone were over the Cornell University thresholds for nematodes. Because of the expense of nematode testing, (approximately $500-600 per field) most potato growers do not have a good idea of the levels in their fields. Nematodes are a potential yield threat. This trial will hopefully supply some data on the levels growers can expect to find on a normal field in the North Country. If we find these cultural practices effective in reducing nematode levels, growers will have a relatively inexpensive tool with which to deal with

the nematode problem. Next year, we will also evaluate for potato yield in these trial fields. It is possible yields will be favorably affected by the green manure treatments.

Both growers said this trial was a good idea. With the right timing, green manure cultural practices can easily fit into potato production practices. The growers look forward to getting an early start with the trial next year. "I was encouraged by what I saw this summer and want to continue with this trail" was what one of the growers said about it. "I learned sudangrass needs N to grow well. Next year I will plant with N and mow it earlier, applying some N at that time if needed".

Next spring, we will sample in the same locations we took the samples this year. Hopefully we will be able to see any impact the green manure may have had on both soil organic matter and nematode levels. We will also conduct yield evaluations in the fields to see what impact these cultural practices may have on yield.

Trials using cultural methods to deal with problems are a good way for growers and Cooperative Extension to show the public they are good stewards of the land. With the publics increased awareness of environmental issues, growers need positive examples of how they are taking care of the land.

These results will be reported at the NYS Vegetable Conference and reports will be distributed for publication in Cooperative Extension and other agricultural publications.